

What is claimed is:

1. A creep-resistant and chemical-resistant ceramic refractory composition comprising a mixed oxide of the general formula  $R_3Al_5O_{12}$  where R is at least one element selected from the group consisting of Dy, Ho, Y, Er, Tm, Yb, and Lu, said mixed oxide having a garnet structure, said mixed oxide further comprising in solid solution at least one dopant selected from the group consisting of transition metal elements and rare-earth elements, said dopant effecting in said composition enhanced optical emission in at least one spectral range.
2. A composition in accordance with claim 1 having a density of at least 85% of theoretical density.
3. A composition in accordance with claim 1 wherein said dopant is present in a concentration in a range of about 1 to about 10 mol %.
4. A composition in accordance with claim 1 wherein said selected spectral range comprises at least one optical wavelength in a range of about 0.25 to about 40  $\mu m$ .
5. A method of making a creep-resistant and chemical-resistant ceramic refractory composition comprising the steps of:
  - a. mixing aluminum oxide and an oxide of at least one element R selected from the group consisting of Dy, Ho, Y, Er, Tm, Yb, and Lu in a molar ratio represented by the general formula  $R_3Al_5O_{12}$ ;
  - b. adding at least one additional dopant element selected from the group consisting of transition metals and rare-earth elements, said dopant element selected to provide enhanced optical emission in at least one selected spectral range; and
  - c. heating said oxide mixture to a temperature of at least 1800°C to form by liquid-phase sintering a densified mixed oxide having a garnet structure, said mixed oxide further comprising said dopant element in solid solution.

6. A method in accordance with claim 5 wherein said heating step is carried out in air and wherein said refractory composition has a final density of at least 85% of theoretical density.
7. A method in accordance with claim 5 wherein said dopant element is present in a concentration in a range of about 1 to about 10 mol %.
8. A method in accordance with claim 5 wherein said selected spectral range comprises at least one optical wavelength in a range of about 0.25  $\mu\text{m}$  to about 40  $\mu\text{m}$ .
9. A super-emissive refractory article comprising a refractory alumina-containing substrate having thereon a coating comprising rare-earth aluminum garnet formed by *in situ* reaction of a selected rare-earth oxide with said alumina, said garnet further comprising at least one optically active dopant selected from the group consisting of transition metal elements and rare-earth elements.
10. A super-emissive refractory article in accordance with claim 9 wherein said base composition comprises at least 85%  $\text{Al}_2\text{O}_3$ .
11. A super-emissive refractory article in accordance with claim 9 wherein said coating has a final thickness of less than about 3 mm.
12. A super-emissive refractory article in accordance with claim 9 wherein said dopant is present in a concentration in a range of about 1 to about 10 mol %.
13. A super-emissive refractory article in accordance with claim 9 wherein said selected spectral range comprises at least one optical wavelength in a range of about 0.25  $\mu\text{m}$  to about 40  $\mu\text{m}$ .
14. An emissive refractory article comprising a refractory alumina-containing substrate having thereon a coating comprising an emissive layer of a rare-earth oxide bonded to said substrate by an interlayer of rare-earth aluminum garnet formed by an *in situ* reaction between said rare-earth and said alumina.

15. An emissive refractory article in accordance with claim 14 wherein said substrate comprises at least 85%  $\text{Al}_2\text{O}_3$ .
16. An emissive refractory article in accordance with claim 14 wherein said emissive layer has a final thickness of less than about 3 mm.
17. An emissive refractory article in accordance with claim 14 wherein said dopant element is present in a concentration in a range of about 1 to about 10 mol %.
18. An emissive refractory article in accordance with claim 14 wherein said selected spectral range comprises at least one optical wavelength in a range of about 0.25  $\mu\text{m}$  to about 40  $\mu\text{m}$ .
19. A super-emissive ceramic refractory composition for use in reducing environments comprising a garnet-structure mixed oxide of the general formula  $\text{R}_3\text{Al}_5\text{O}_{12}$  where R is an element selected from the group consisting of Dy, Ho, Y, Er, Tm, Yb, and Lu, said mixed oxide further comprising in solid solution at least one additional dopant element selected from the group consisting of transition metals and rare-earth elements, said dopant element selected to provide an enhanced optical emission in at least one selected spectral range, said refractory composition being resistant to reduction and quenching of said optical emission by a reducing environment.
20. A super-emissive refractory composition in accordance with claim 19 having a density of at least 85% of theoretical density.
21. A super-emissive refractory composition in accordance with claim 19 wherein said dopant element is present in a concentration in a range of about 1 to about 10 mol %.
22. A super-emissive refractory composition in accordance with claim 19 wherein said selected spectral range comprises optical wavelengths in a range of about 0.25  $\mu\text{m}$  to about 40  $\mu\text{m}$ .